BLUETOOTH ACTIVATED DC MOTOR

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"I hereby acknowledge that the scope and quality of this thesis is qualified for the award of the Bachelor Degree of Electrical Engineering (Electronics)"

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Specially Dedicated

To my beloved Parents

My siblings and also my friends

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ABSTRACT

Nowadays, Bluetooth is a common way to connect and transfer information between things such as cell phones, laptops and PCs, printers, and digital cameras. The idea of using Bluetooth technology also a big motivation as it is interested in obtaining a much more comprehensive understanding of how it works. The goal of this project is to design a controller that will be able to run a DC motor wirelessly using Bluetooth technology. This controller will be able to function through a software application on a laptop or desktop computer from within a distance of the motor. This project involved three main parts to be developed, which are hardware, circuit and software. The hardware parts consists the materials that are used to build. The circuit part consists of the microcontroller circuit, because the microcontroller is known as a brain of the circuit. All the movement will be assigned by using microcontroller. The software part is to design the programming that will be used to assign an angle of movement for each DC motor.

ABSTRAK

Pada masa kini, Bluetooth adalah satu cara yang biasa digunakan untuk menghantar maklumat seperti telefon bimbit, komputer riba, pencetak dan kamera digital. Penggunaan idea menggunakan teknologi Bluetooth merupakan satu motivasi besar di mana penggunaannya adalah sangat menarik. Matlamat projek ini adalah mereka rekaan pengawal motor dengan menggunakan teknologi Bluetooth. Pembinaan projek ini terbahagi kepada tiga bahagian utama iaitu perkakasan, litar, dan perisian. Pembinaaan perkakasan adalah proses untuk membina iaitu proses pemilihan bahan dan reka bentuk yang sesuai. Pembinaan litar adalah proses pembinaan litar pengawalmikro yang berfungsi sebagai otak. Ini kerana semua pergerakan motor dikawal oleh pengawalmikro. Pembinaan perisian adalah pembinaan aturcara untuk digunakan dalam mengawal pergerakan motor.

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LIST OF ABBREVIATIONS

AC	Alternating Current
DC	Direct Current
I/O	Input / Output
IC	Integrated Circuit
PIC	Programmable Intelligent Computer
PC	Personal Computer
Rx	Receive
Tx	Transmit
SPP	Serial Port Profile
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver Transmitter

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Bluetooth is an industrial specification for wireless personal area networks (PANs). It provides a way to connect and exchange information between devices such as mobile phones, laptops, PCs, printers, and digital cameras globally unlicensed short-range radio frequency. This latest technology was never designed to provide for anything other than short-range connectivity and communications.
This short-range limitation is in fact a benefit that was purposely designed into the specifications. [3]

1.2 What are the Benefits of Bluetooth

As more and more devices start to use Bluetooth technology, more manufacturers will be eager to make their products compatible. A chain reaction will occur, making Bluetooth the standard for cutting edge wireless. One of the benefits of the short-range design of its networking is the possibility of interference from devices belonging to others who are in close proximity. This keeps others from connecting with user devices and is a form of basic security intended to protect the devices and data.

Another benefit of limiting the range of networking devices is that less power is required for the transmission over shorter distances. This in turn means that user can enjoy longer battery life, and since the majority of its enabled products are powered by battery, this is an important feature for most users. This 'Bluetooth Activated DC Motor' is operating which is manually. Here a Bluetooth module KC21 was used. In response to receive signal from the device, a laptop may send instructions to the device via Bluetooth to activate it. The laptop is directed to a system for electronically activate the dc motor which is the microcontroller is the brain of the system.

1.3 Objectives

There are several objective of this project that try to achieve:

(i) To use Bluetooth communication link in transmitting and receiving process

(ii) To activate and control DC motor from a distance

1.4 Scopes

This project focuses on establishing Bluetooth connection. The operation of the devices attached to the slave module must be able being controlled by the master module. To complete the project objective, the following criteria are set into consideration: The scopes of this project are:

(i) In order to use Bluetooth, a device must be compatible with certain Bluetooth profiles. These define the possible applications and uses of the technology.

(ii) Develop the program to control the microcontroller for DC motor.

(iii) The motor is able being activated through a wireless connection on a laptop via Bluetooth

(iv) Develop the circuit for the DC motor control.

1.5 Thesis Outline

Chapter 1 explains the idea of this project. The objective and the scope of the project are also described in this section.

Chapter 2 provides a brief explanation on the existing technology and system that has a similar function with this project. The literature reviews were used as the main reference for this project.

Chapter 3 describes the entire system design to accomplish this project. This chapter has the detail explanation on the hardware as well as the hardware configuration that has been developed in the project.

Chapter 4 provides the result and analysis obtained from the project. It is based on the result and the overall performances of the system design.

Chapter 5 gives the conclusion and recommendation which may improvise this project in the future. This chapter also cites the cost of the project and the potential of this project to be commercialized.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In order to make this project successful, some studies and information has been done. The information is fetching from many sources such as books, articles, journals, and internet. All of this information is very useful as a guide in doing this project. This studies of information based on some major component and topic that related to the project that will be used in the project such as hardware and software.

2.2 Communication

Bluetooth is the name of a wireless technology standard for connecting devices, set to replace cables. It uses radio frequencies in the 2.45 GHz range to transmit information over short distances of generally 33 feet (10 meters) or less. Bluetooth provides a way to connect and exchange information between devices like personal digital assistants (PDAs), mobile phones, laptops, PCs, printers and digital cameras via a secure, low-cost, globally available short range radio frequency. Bluetooth lets these devices talk to each other when they come in range, even if they are not in the same

room, as long as they are within up to 100 meters (328 feet) of each other, dependent on the power class of the product. Products are available in one of three power classes:

i. Class 3 (1 mW) is the rarest and allows transmission of 10 centimeters (3.9 inches), with a maximum of 1 meter (3.2 feet)

ii. Class 2 (2.5 mW) is most common and allows a quoted transmission distance of 10 meters (32 ft)

iii. Class 1 (100 mW) has the longest range at up to 100 meters. This class of product is readily available.

The specification was first developed by Ericsson, and was later formalized by the Bluetooth Special Interest Group (SIG). The SIG was formally announced on May 20, 1999. It was established by Sony Ericsson, IBM, Intel, Toshiba and Nokia, and later joined by many other companies as Associate or Adopter members. [4]

2.2 Bluetooth Technology

Automatic communication between various devices within a small area in a house or an office makes it possible to provide unique and innovative services to a professional worker or a small group of workers using portable devices. Bluetooth technology has this potential and is coming along fast and quick. It will replace clumsy wires, make information transfer automatic without synchronization cradles and introduce many new applications. Technology visionaries hope that it will do what infra red could not do over the past six years. Figure 2.1 below shows how the Bluetooth connected.

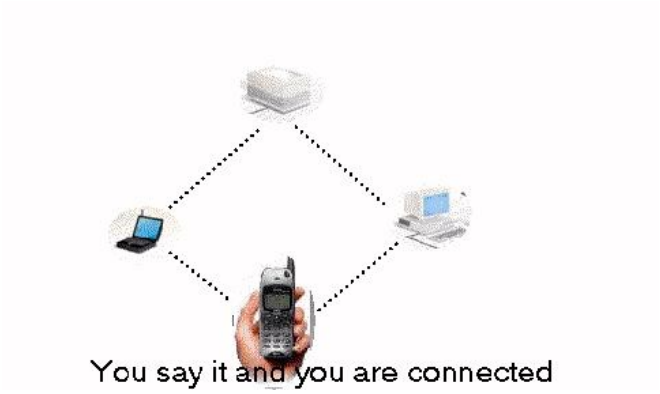

Figure 2.1: Bluetooth Connection

2.3.1 How Bluetooth Technology Works

This technology achieves its goal by embedding tiny, inexpensive, short-range transceivers into the electronic devices that are available today. The radio operates on the globally-available unlicensed radio band, 2.45 GHz (meaning there will be no hindrance for international travelers using Bluetooth-enabled equipment.), and supports data speeds of up to 721 Kbps, as well as three voice channels. The Bluetooth modules can be either built into electronic devices or used as an adaptor. For instance in a PC they can be built in as a PC card or externally attached via the USB port. [3] Figure 2.2 below show the Different Functional Blocks in the Bluetooth System.

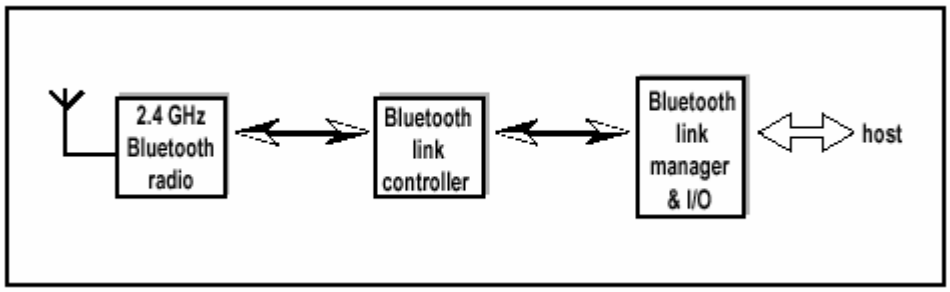

Figure 2.2: Different Functional Blocks in the Bluetooth System

2.3.2 Bluetooth Technology and Transceiver

Bluetooth Technology is standard for short-range radio communication. It is a low cost bi-directional (2 ways) wireless interface between mobile devices that provides low power consumption. Bluetooth Transceiver referring to Bluetooth Transmitter and Receiver and every Bluetooth node have Bluetooth Transceiver. The aim is to eliminate the usage of cables. Bluetooth system operates in worldwide unlicensed 2.4GHz Industrial-Scientific-Medical (ISM) frequency band. Bluetooth devices can form a network. The basic network is Piconet where there are masters node and other act as slave node/s. At least 2 nodes are required to form Bluetooth network, either one of the nodes can be master. The role of master is just to search and initiate the connection, once the link is established; the role of each node is equal.

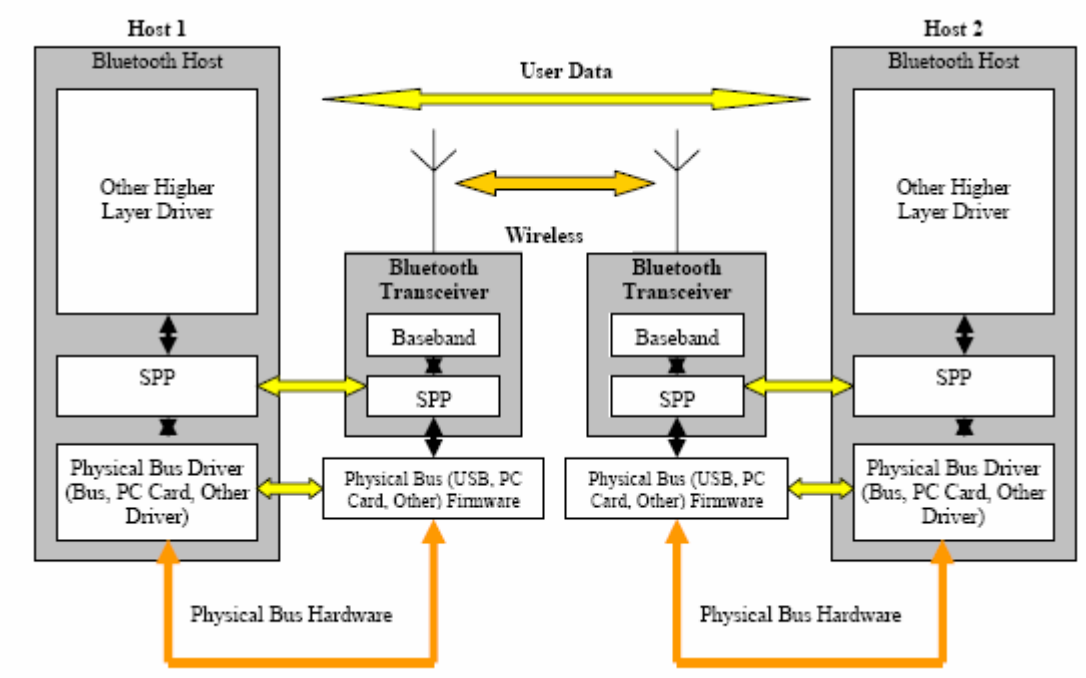

Figure 2.3: Host to host communication through Bluetooth Transceivers

Bluetooth transceiver is a wireless transceiver that transmits and receives. Signal wirelessly through Bluetooth protocol, thus a host, or in other words a controller is necessary if data processing is required in the application. As shown from the above figure, there are two hosts (Host 1 and 2, it can be microcontroller, computer, PDA,

etc) and two Bluetooth transceivers. Both host need to communicate (exchange data), while Bluetooth transceiver is the tools to transfer the data between host. Thus, to process data and operate Bluetooth transceiver, a controller is necessary. There are few methods to connect Bluetooth transceiver to host, where most common used are UART and USB. KC Bluetooth transceiver use UART to communicate. SPP (Serial Port Profile) is a Bluetooth standard profile which provides the platform for a host to communicate with Bluetooth transceiver serially. [11]

2.3.3 UART

UARTs (**U**niversal **A**synchronous **R**eceiver **T**ransmitter) are serial chips on your PC motherboard (or on an internal modem card). The UART function may also be done on a chip that does other things as well. On older computers like many 486's, the chips were on the disk IO controller card. Still older computer have dedicated serial boards.

When PCs all had parallel bus architecture, the UART's purpose was to convert bytes from the PC's parallel bus to a serial bit-stream. The cable going out of the serial port is serial and has only one wire for each direction of flow. The serial port sends out a stream of bits, one bit at a time. Conversely, the bit stream that enters the serial port via the external cable was converted to parallel bytes that the computer can understand. UARTs deal with data in byte sized pieces, which is conveniently also the size of ASCII characters.

Say you have a terminal hooked up to a serial port on your PC. When you type a character, the terminal gives that character to its transmitter (also a UART). The transmitter sends that byte out onto the serial line, one bit at a time, at a specific rate. On the PC end, the receiving UART takes all the bits and reconstruct the byte (parallel on older PCs) and puts it in a buffer. For newer PCs that might have a PCI-e serial port, the UART doesn't need to convert parallel-to-serial since the PCI-e "bus" is already a serial

line. But the PCI-e line carries an encoded signal which must be decoded and then greatly slowed down to the speed of the RS-232 serial line.

Along with converting between serial and parallel, the UART does some other things as a byproduct (side effect) of its primary task. The voltage used to represent bits is also converted (changed). Extra bits (called start and stop bits) are added to each byte before it is transmitted. Also, while the flow rate (in bytes/sec) on the parallel bus inside the computer is very high, the flow rate out the UART on the serial port side of it is much lower. The UART has a fixed set of rates (speeds) which it can use at its serial port interface. [9]

2.4 DC Motor

DC motors are usually available in two general types. Alike, AC motors also come in two different types. They can be two phase or three phase AC motors. Although on technical front, the differences in DC and AC motors are sometimes marginal, but some of these differences make one types better than the other for a certain use. In general, the DC electric motors work for conditions controlling the speed is essential. It is due to the factor that DC motors have a steady and constant current. DC motors are also the first and earliest motors used. But these good factors are also accompanied with some limitations; for instance, the DC electric motors are incapable of producing power over long period of time. [6]

2.4.1 Advantages of DC Motor

A DC motor is an electric motor that runs on direct current (DC) electricity. DC motors provide excellent speed control for acceleration and deceleration with effective and simple torque control. The fact that the power supply of a DC motor connects

directly to the field of the motor allows for precise voltage control, which is necessary with speed and torque control applications.

DC motors perform better than AC motors on most traction equipment. They are also used for mobile equipment like golf carts, quarry and mining equipment. DC motors are conveniently portable and well suited to special applications, such as industrial tools and machinery that is not easily run from remote power sources. [6] Figure 2.3 below show the picture of various kind of DC motor.

Figure 2.4: DC Motor

2.4.2 How Does DC motor work

A DC motor works by converting electric power into mechanical work. This is accomplished by forcing current through a coil and producing a magnetic field that spins the motor. The simplest DC motor is a single coil apparatus, used here to discuss the DC motor theory.

The voltage source forces voltage through the coil via sliding contacts or brushes that are connected to the DC source. These brushes are found on the end of the coil wires and make a temporary electrical connection with the voltage source. In this motor,

the brushes will make a connection every 180 degrees and current will then flow through the coil wires. At 0 degrees, the brushes are in contact with the voltage source and current is flowing. The current that flows through wire segment C-D interacts with the magnetic field that is present and the result is an upward force on the segment. The current that flows through segment A-B has the same interaction, but the force is in the downward direction. Both forces are of equal magnitude, but in opposing directions since the direction of current flow in the segments is reversed with respect to the magnetic field. At 180 degrees, the same phenomenon occurs, but segment A-B is forced up and C-D is forced down. At 90 and 270-degrees, the brushes are not in contact with the voltage source and no force is produced. In these two positions, the rotational kinetic energy of the motor keeps it spinning until the brushes regain contact. [6]

2.5 Microcontroller

A microcontroller is a single-chip device that contains memory for the program information and data. It has logic for programmed control reading inputs, manipulating data, and sending outputs as well as the central processing unit (CPU) that has built-in interface for input/output (I/O). Microcontroller Unit (MCU) has built-in interface capability is used for sensors, actuators, and communications [8]

2.5.1 PIC Microcontroller

The PIC was developed as a peripheral controller. PIC (Peripheral Interface Controller) is the IC which was developed to control peripheral devices, alleviating the load from the main CPU. Compared to a human being, the brain is the main CPU and the PIC is equivalent to the autonomic nervous system. [7]